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DiTomasso

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(54) **TURBINE ENGINE BEARING SUPPORT**

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(52) **U.S. Cl.** **415/9**; 415/142; 415/173.4; 415/229

(58) **Field of Classification Search** 415/9, 415/142, 173.4, 174.4, 229
See application file for complete search history.

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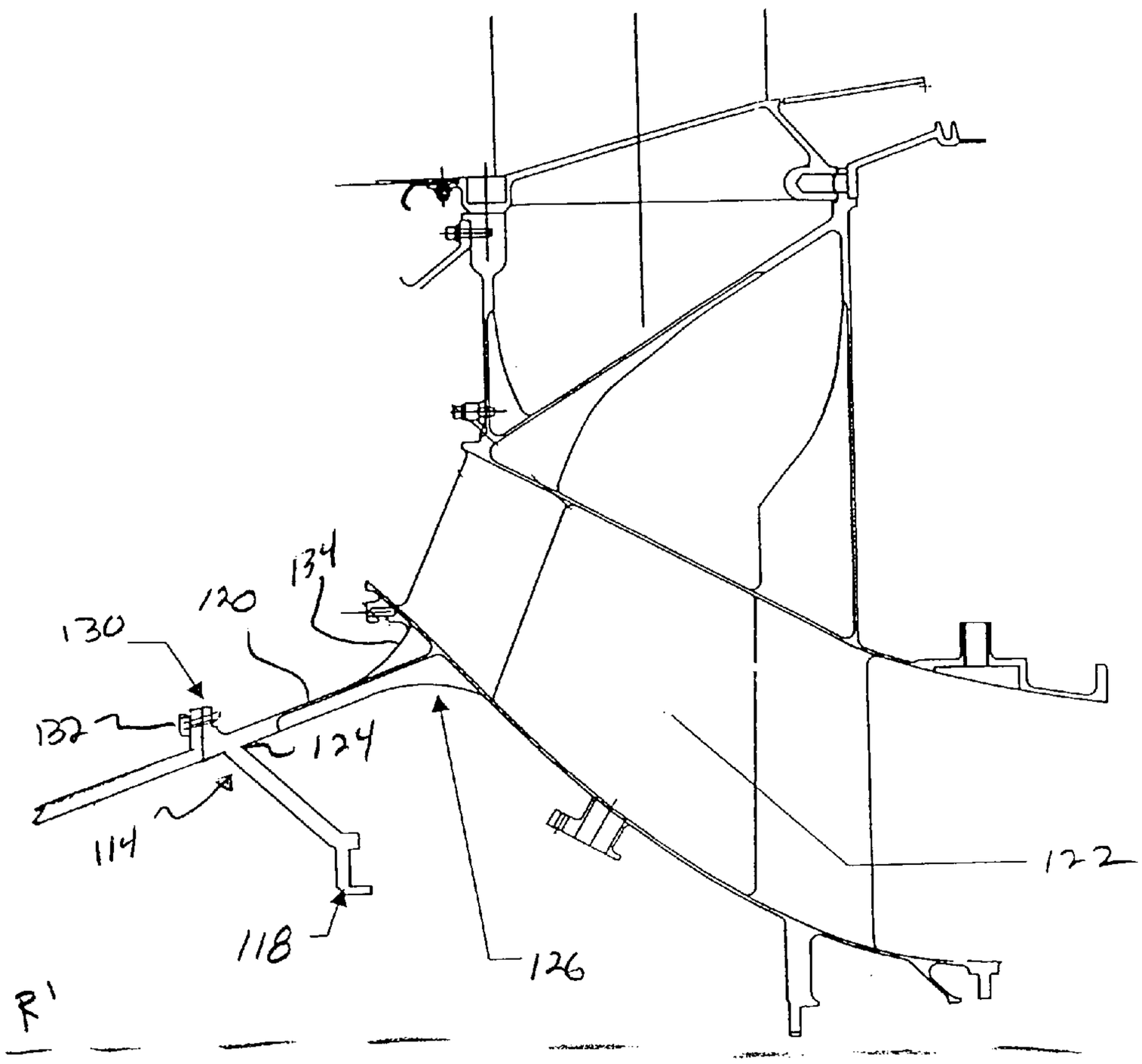
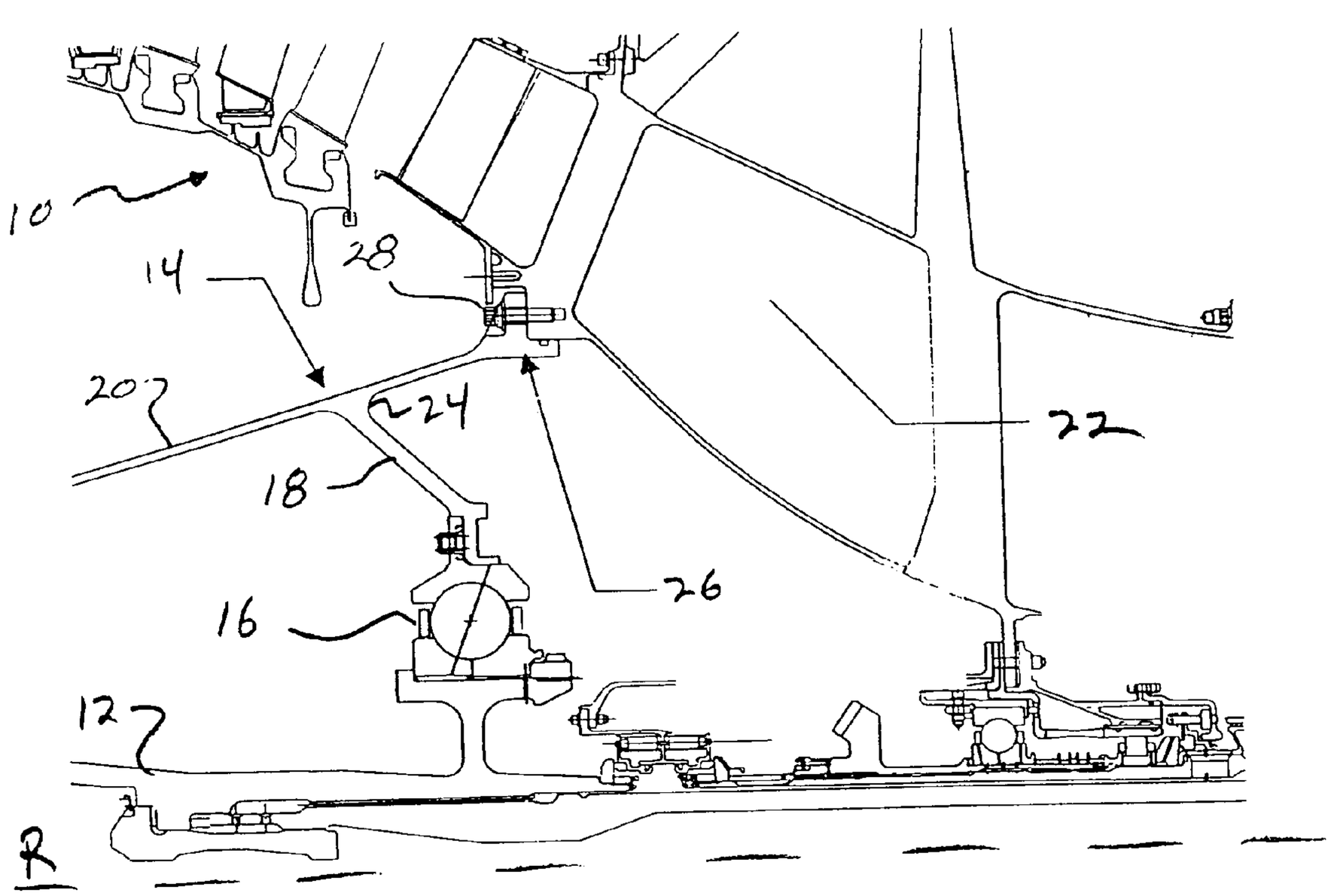
(57) **ABSTRACT**

A bearing support for a rotor of an aircraft turbine engine which includes a front bearing and a front bearing support and bearing strut for securely attaching the front bearing, to the aircraft turbine engine support structure, wherein the front bearing support and bearing strut are integral with the aircraft turbine engine support structure.

3 Claims, 3 Drawing Sheets





PRIOR ART

FIG. 1

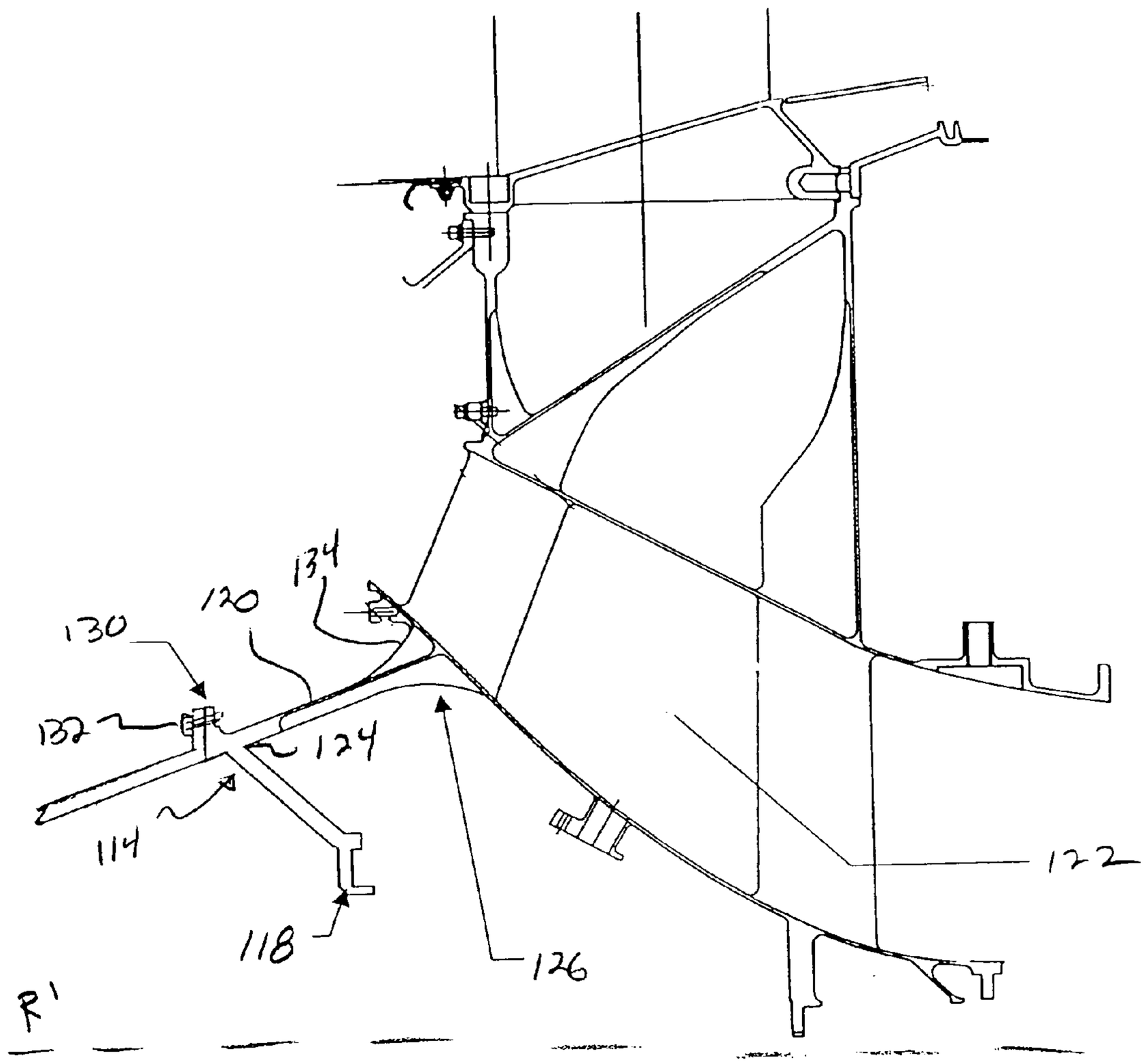


FIG. 2

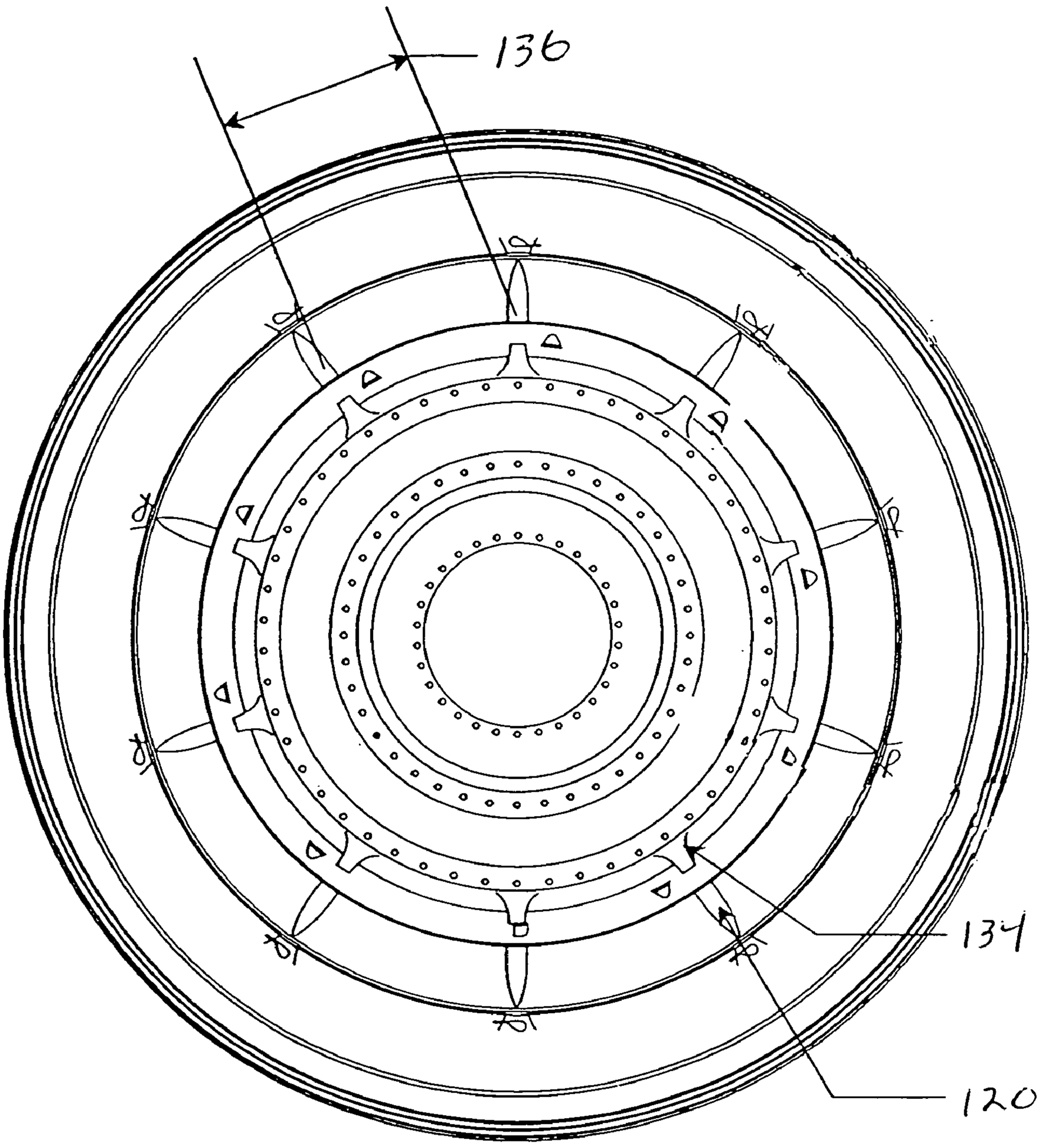


FIG. 3

TURBINE ENGINE BEARING SUPPORT

BACKGROUND OF THE INVENTION

The present invention relates to an aircraft turbine engine bearing support which eliminates or greatly minimizes stress concentration on the joint or interface between the bearing supports and the aircraft turbine engine support structure, and provides improved stiffness at the joint or interface.

An aircraft turbine engine bearing support system includes a front bearing and a rear bearing, and a first and second bearing support for securely attaching the front bearing and the rear bearing to the aircraft turbine engine support structure. The first bearing support is generally bolted to the aircraft turbine engine support structure, the second bearing support connected to the first bearing support. U.S. Pat. No. 6,428,269 shows such a system. The bolted joint or interface creates an undesirable high stress concentration and reduces the strength of the unit.

It is highly desirable and an object of the present invention to overcome these disadvantages and provide a turbine engine bearing support that eliminates or greatly reduces high stress concentration on the joint or interface between the bearing supports and the aircraft turbine engine support structure.

A further object of the present invention is to provide a turbine engine bearing support that provides increased stiffness and improved strength.

Further objects and advantages of the present invention will appear hereinbelow.

SUMMARY OF THE INVENTION

In accordance with the present invention it has now been found that the foregoing objects and advantages are readily obtained.

The present invention comprises: an aircraft turbine engine including a rotor having a shaft which rotates about an axis of rotation during balanced engine operation; a front bearing and a bearing support structure for supporting the shaft for rotation, said bearing support structure including a front bearing support and a bearing strut for securely attaching the front bearing to the aircraft turbine engine support structure, wherein the bearing strut is integral with the turbine engine support structure, and desirably the joint or interface between the bearing strut and the aircraft turbine engine support structure is a one-piece casting. Desirably, the front bearing support is integral with the bearing strut so that the front bearing support and bearing strut are an integral unit and preferably a one-piece casting with said aircraft turbine engine support structure. Desirably, also, the front bearing support extends between the front bearing and the bearing strut so that an integral joint or interface is provided between the front bearing support, and the bearing strut and the aircraft turbine engine support structure.

Further features of the present invention will appear hereinbelow.

BRIEF DESCRIPTION

The present invention will be made readily understandable from a consideration of the following illustrative drawings, wherein:

FIG. **1** is a partial sectional view illustrating a prior art aircraft turbine engine bearing support;

FIG. **2** is a partial sectional view similar to FIG. **1** illustrating a representative embodiment of a turbine bearing support of the present invention; and

FIG. **3** is a front view of the turbine bearing support of FIG. **2**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will be described with reference to well known aircraft turbine engines per se, with FIG. **1** showing a prior art bearing support system.

With reference to FIG. **1**, a fan stage of an aircraft turbine engine **10** includes a fan stage having a fan rotor shaft **12** which rotates around a geometric axis of rotation R. The fan stage as well known includes a plurality of fan blades regularly distributed around the periphery of the rotor shaft **12**.

The rotor shaft **12** is guided during normal rotation of the shaft around the geometric axis R on a bearing support system **14** which includes a front bearing **16** and a rear bearing (not shown), and a front bearing support **18** connected to a bearing support strut **20** for attaching the front bearing **16** to the engine support structure **22**. The rear bearing is also connected to the bearing support system with the front bearing positioned between the engine support structure and the rear bearing.

In accordance with FIG. **1**, the front bearing support **18** is connected to the bearing strut **20** at a joint **24** which is located at a distance from the joint **26** between the strut **20** and the engine support structure **22**.

However, it can be clearly seen in FIG. **1** that the bearing support system is connected to the engine support structure at interface **26** by bolting **28**. This results in a high stress concentration on the joint or interface between the bearing support strut and engine support structure, reduces the stiffness of the joint and decreases the strength thereof. Also, this requires a large flange and large bolts to withstand the locally high loads, with minimal distortion.

In accordance with the structure of the present invention shown in FIG. **2**, a fan stage of an aircraft turbine engine **100** is provided which is generally similar to that shown in FIG. **1**.

As with FIG. **1**, a rotor shaft is guided during normal rotation of the shaft around the geometric axis R' on a bearing support system **114** which includes a front bearing and a rear bearing (not shown), and a front bearing support **118** and a bearing support strut **120** for attaching the front and rear bearings to the engine support structure **122**.

However, as can be clearly seen in FIG. **2**, the bearing support strut **120** is integral with the turbine engine support structure **122** and the joint or interface **126** between the strut **120** and the turbine engine support structure **122** is a one-piece casting which extends outwardly from the engine support structure **122** to the front bearing support **118** at integral interface **124**. Thus the front bearing support **118** is integral with the bearing strut **120**, and the front bearing support and bearing strut form a one-piece casting with the aircraft turbine engine support structure **122**.

As shown in FIG. **2**, the front bearing support **118** extends from the front bearing to strut **120**, and strut **120** extends to the engine support structure **122** and includes an integral interface or joint **126** between the strut **120** and engine support structure plus an integral interface **124** between front bearing support **118** and strut **120**, which overcomes the disadvantages of the bolted joint or interface **26** of FIG. **1**.

Strut flange **130** is provided on the bearing support strut **120** spaced away from the integral interface **124** between front bearing support **118** and strut **120**, i.e., integral interface **124** is positioned between strut flange **130** and support structure **122**. Strut flange **130** is connected together by bolt **132**. By moving the bolted struct flange forward, away from the engine support structure **122** and away from the front bearing support **118**, the local stresses at the strut flange are minimized, allowing a lighter flange, with smaller and/or fewer bolts. Large strut gussets **134** are used at the struts to fair the strut structure into the thin hoop structure of the bearing support. The gussets, and the fairing of the structure is not possible with the typical design. Since the gussets are local to struts, the parasitic mass between the struts is reduced. The large gussets also serve to stiffen the structure considerably, with adding minimal weight. In order to have enough room to fair the structure smoothly, the distance between the flange **130** and the engine support structure **122** should preferably be at least half the span **136** in-between struts.

The structure of the present invention provides considerable advantages. The bolted joint between the support strut and the aircraft turbine engine support structure is eliminated, which eliminates the high stress concentration on the joint by eliminating the bolted joint and provides the advantages discussed above. The fully integrated joint or interface provides a stiffer structure with higher strength. In addition, the interface between the front bearing support is integral with the strut and moved away from the engine support structure, thereby minimizing stress and increasing strength.

It is to be understood that the invention is not limited to the illustrations described and shown herein, which are deemed to be merely illustrative of the best modes of carrying out the invention, and which are susceptible of modification of form, size, arrangement of parts and details of operation. The invention rather is intended to encompass all such modifications which are within its spirit and scope as defined by the claims.

What is claimed is:

1. In an aircraft turbine engine comprising: a rotor having a shaft which rotates about an axis of rotation during balanced engine operation; a front bearing and a bearing support structure for supporting the shaft for rotation, said bearing support structure including a front bearing support and a bearing strut for securely attaching the front bearing to the aircraft turbine engine support structure, wherein the bearing strut is a one piece cast structure with a portion of the aircraft turbine engine support structure; and a strut flange with a bolted joint on the bearing strut, wherein a first integral joint is positioned between the front bearing support and the bearing strut and a second integral joint is positioned between the bolted joint and the engine support structure, and including a plurality of spaced apart struts, wherein the distance between the strut flange and the engine support structure is at least half the span in between struts.

2. The aircraft turbine engine according to claim **1**, wherein said front bearing support is a one piece cast structure with the bearing strut so that the front bearing support and bearing strut are an integral unit.

3. The aircraft turbine engine according to claim **1**, wherein the front bearing support is connected to the bearing strut at the integral joint which is located at a distance from the engine support structure.

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